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AEROSOL MEASUREMENTS OVER THE PACIFIC OCEAN IN SUPPORT OF THE IR AEROSOL BACKSCATTER PROGRAM

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ABSTRACT

Becasue of a delay in the GLOBE survey flights, only samples from the first suvaey flight were available by the end of the grant period. The major data analysis and work-up will occur after the data are acquired from the second survey flight.

1) During the first GLOBE Survey Flight, daily samples were collected at four stations (Midway, Rarotonga, American Samoa, and Norfolk Island) throughout the month of November 1989. Weekly samples were collected at Karamea and Shemya. A total of 122 samples and 56 field blanks will be analyzed as part of this study. These samples are now in-hand and are currently being analyzed for sodium (sea-salt), chloride, nitrate, sulfate and methanesulfonate at the University of Miami and for aluminum at the University of Rhode Island (under a subcontract).
2) The results obtained from the above studies will become part of the GLOBE data base for comparison with data from instruments used aboard the aircraft. In addition, the data will be compared with data previously obtained at these stations as part of the Sea-Air Exchange (SEAREX) Program. This comparison will provide valuable information on the representativeness of the periods in terms of the longer term aerosol climatology over the Pacific Ocean.

RESULTS

During the third year of the grant, the primary emphasis was on measuring near surface aerosol concentrations on a daily basis at four stations in the Pacific Ocean during the first Global Backscatter Experiment survey flight in November 1989. At each of four stations - Midway, American Samoa, Rarotonga and Norfolk Island (Figure 1) - samples were collected every day and field blanks were taken every other day throughout November. The usual weekly samples were collected at Shemya and at Karamea during the same time period; at these stations, a blank was taken for every sample. Unfortunately, because of personnel problems, we were unable to obtain any samples at the Oahu station during the flight. Overall, the remaining stations operated very well. For the most part, even the winds were favorable, being off the ocean a reasonable percentage of the time. All of the samples and blanks have now been received and are currently being analyzed.

A total of 122 samples and 56 blanks were obtained during the experiment, including the 5 weekly samples from each of Shemya and Karamea. Itemized lists of the samples and blanks that were obtained from each station are presented in Tables 1 through 6. To minimize contamination from local sources, our samplers are attached to wind sensors which turn on the pumps only when the wind is off the ocean at a speed greater than 1 $m\ s^{-1}$ (this condition is referred to as in-sector). During some periods at each station, the winds were out-of-sector a significant portion of the time. With a substantial reduction in sample volume, the sampled concentrations can remain near the levels of the blanks and, consequently, the individual measured concentrations are frequently unreliable. In the past for the Sea-Air Exchange (SEAREX) program and again in the Air-Ocean Chemistry Experiment (AEROCE), we have considered samples with percent in-sector times of less than 10% to be unreliable even though there is often no evidence of a problem even with in-sector times of 5% or less. During the period of the first GLOBE Survey Flight, the winds were generally favorable and a high percentage of the samples are expected to provide reliable results. Of the 122 samples that were collected, 87% had in-sector times of greater than 20% and 64% had in-sector times of greater than 80%.

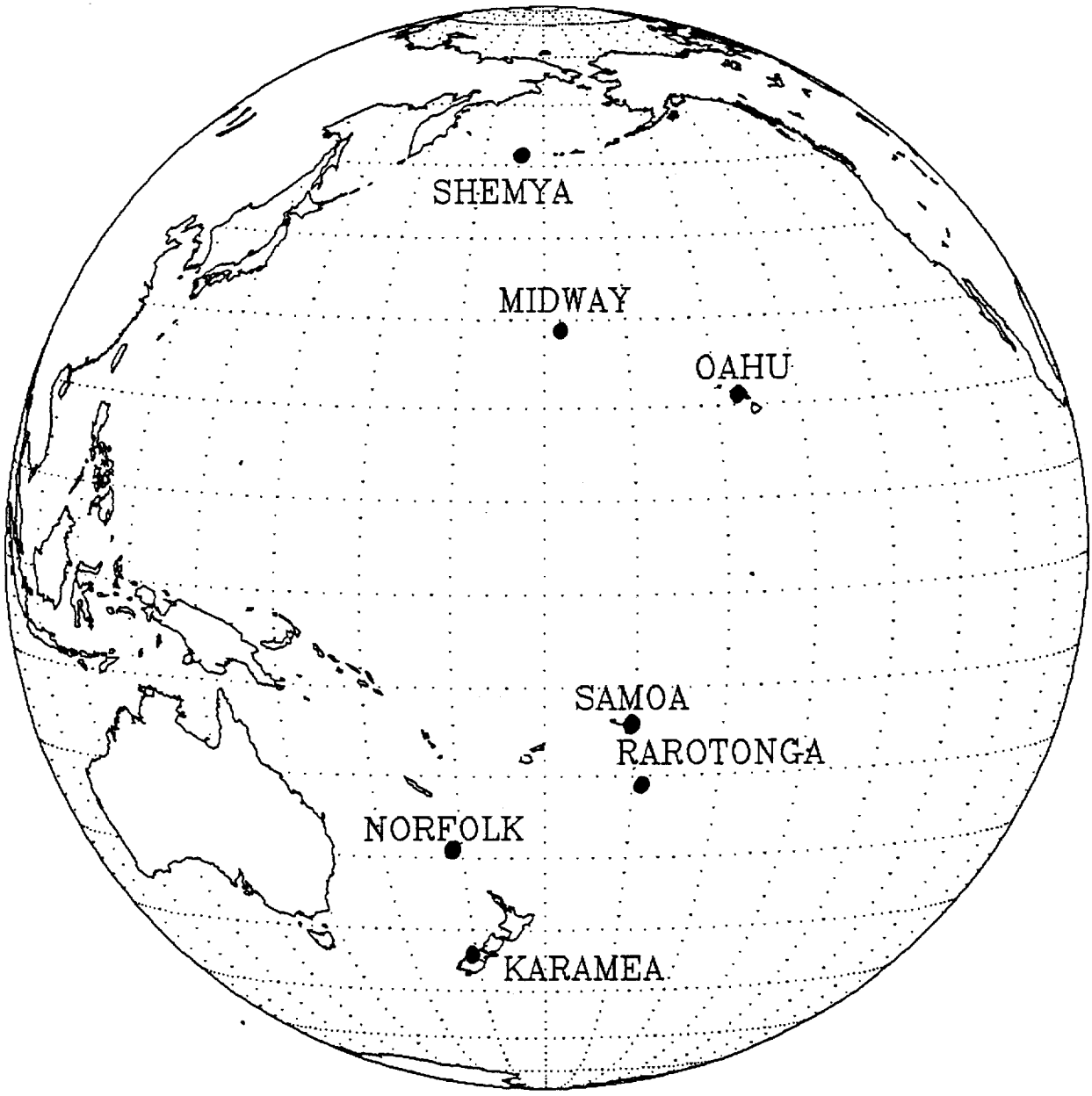
As might be expected, the in-sector percentages varied considerably from location to location. Here we briefly discuss, the variations at the four stations where daily sampling took place; specific details are available from the data in the tables. At Midway, 26 of the 30 samples had in-sector times greater than 20%; in fact, all of those were over 50%. One of the low percentages occurred on November 7 and the other three occurred during the last ten days of the month. At American Samoa, 24 of the 26 samples had in-sector times greater than 20%; the low percentages were for the last two samples of the month (November 29-30 and November 30-December 1). At Rarotonga, the situation was somewhat less favorable but still quite reasonable with 21 of the 30 samples (about two-thirds) having in-sector times greater than 20%. Two of the low percentage samples occurred from November 9-11 and the other 7 during the last 10 days of the month. The worst case was at Norfolk which experienced a lengthy period of northerly winds from the end of October through early November; northerly winds are very unusual for Norfolk at this time of year. Consequently, in-sector times were at or near 0% for most of the samples collected during the first half of November. In contrast, only one sample collected after November 14 had an in-sector time which was less than 20%.

Despite the poor weather conditions at Norfolk Island early in the experiment, the overall program was successful. We have obtained a large percentage of reasonably high volume samples together with a large number of field blanks. Consequently, there should be more than sufficient high quality data for statistically valid comparisons with other data sets. In fact, there should be enough data from each

of these stations to obtain reasonable estimates of the frequency distributions of the daily-averaged concentrations.

Although personnel problems prevented us from obtaining any samples at Oahu during the period of the survey flight, we have taken steps to alleviate this problem. At the American Geophysical Union 1989 Fall Meeting, one of the PI's (DLS) met with Mr. John Porter, a graduate student of Dr. Antony Clarke of the University of Hawaii. Dr. Clarke is also actively involved in the GLOBE effort and has had a strong interest in atmospheric physics and chemistry for a number of years. Mr. Porter expressed a strong interest in performing the necessary maintenance at the site and in taking over the responsibility for changing the filters. We have since contacted Mr. Porter and requested that he assume those duties. We are confident that the contacts with the University of Hawaii will be a significant asset with regard to this station, and that the station will resume operation in the near future. Indeed, Clarke's group has expressed an interest in using the tower site for some of his own research in the future.

UNIVERSITY OF MIAMI
PACIFIC AEROSOL NETWORK



NASA/GLOBE
GLOBAL BACKSCATTER EXPERIMENT

TABLE 1. MIDWAY, SAMPLE PARAMETERS FOR NOVEMBER 1989

FILTER TYPE (S/B)	DATE ON (UTC)	TIME ON (UTC)	DATE OFF (UTC)	TIME OFF (UTC)	TOTAL TIME (hrs)	RUN TIME (hrs)	RUN TIME (%)	FLOW RATE (m^3/hr)	AIR VOLUME (m^3)
Sample	01-Nov-89	18:40	02-Nov-89	18:20	23.67	16.70	70.6	46.18	771.2
Sample	02-Nov-89	18:30	03-Nov-89	18:20	23.83	23.80	99.9	49.79	1185.1
Sample	03-Nov-89	18:35	04-Nov-89	18:30	23.92	24.00	100.3	47.11	1130.6
Sample	04-Nov-89	18:40	05-Nov-89	18:30	23.83	23.90	100.3	48.91	1169.0
Blank	05-Nov-89		05-Nov-89						
Sample	05-Nov-89	18:40	06-Nov-89	18:15	23.58	23.50	99.6	49.79	1170.1
Sample	06-Nov-89	18:25	07-Nov-89	18:25	24.00	17.80	74.2	48.02	854.7
Blank	07-Nov-89		07-Nov-89						
Sample	07-Nov-89	18:35	08-Nov-89	18:20	23.75	1.70	7.2	48.91	83.2
Sample	08-Nov-89	18:30	09-Nov-89	18:20	23.83	23.10	96.9	46.64	1077.5
Blank	09-Nov-89		09-Nov-89						
Sample	09-Nov-89	18:30	10-Nov-89	19:10	24.67	24.80	100.5	48.91	1213.1
Sample	10-Nov-89	19:20	11-Nov-89	18:30	23.17	23.30	100.6	48.91	1139.7
Blank	11-Nov-89		11-Nov-89						
Sample	11-Nov-89	18:40	12-Nov-89	18:35	23.92	23.90	99.9	50.66	1210.7
Sample	12-Nov-89	18:45	13-Nov-89	18:20	23.58	23.70	100.5	46.18	1094.4
Blank	13-Nov-89		13-Nov-89						
Sample	13-Nov-89	18:35	14-Nov-89	18:25	23.83	24.00	100.7	49.35	1184.5
Sample	14-Nov-89	18:35	15-Nov-89	18:25	23.83	23.90	100.3	47.11	1125.9
Blank	15-Nov-89		15-Nov-89						
Sample	15-Nov-89	18:35	16-Nov-89	18:25	23.83	23.80	99.9	46.18	1099.0
Sample	16-Nov-89	18:35	17-Nov-89	19:20	24.75	24.80	100.2	48.02	1190.9
Blank	17-Nov-89		17-Nov-89						
Sample	17-Nov-89	19:30	18-Nov-89	18:30	23.00	23.00	100.0	47.11	1083.5
Sample	18-Nov-89	18:30	19-Nov-89	18:30	24.00	24.10	100.4	50.66	1220.8
Blank	19-Nov-89		19-Nov-89						
Sample	19-Nov-89	18:40	20-Nov-89	18:35	23.92	23.90	99.9	47.11	1125.9
Sample	20-Nov-89	18:45	21-Nov-89	18:20	23.58	23.70	100.5	48.91	1159.2
Blank	21-Nov-89		21-Nov-89						
Sample	21-Nov-89	18:35	22-Nov-89	18:25	23.83	19.20	80.6	47.11	904.5
Sample	22-Nov-89	18:40	23-Nov-89	18:15	23.58	0.60	2.5	48.91	29.3
Blank	23-Nov-89		23-Nov-89						
Sample	23-Nov-89	18:30	24-Nov-89	18:20	23.83	12.30	51.6	49.79	612.4
Sample	24-Nov-89	18:30	25-Nov-89	18:20	23.83	22.30	93.6	46.18	1029.8
Blank	25-Nov-89		25-Nov-89						
Sample	25-Nov-89	18:30	26-Nov-89	18:35	24.08	17.50	72.7	48.91	856.0
Sample	26-Nov-89	18:45	27-Nov-89	18:25	23.67	20.20	85.4	46.18	932.8
Blank	27-Nov-89		27-Nov-89						
Sample	27-Nov-89	18:35	28-Nov-89	18:25	23.83	4.70	19.7	48.91	229.9
Sample	28-Nov-89	18:35	29-Nov-89	18:25	23.83	23.30	97.8	47.11	1097.6
Blank	29-Nov-89		29-Nov-89						
Sample	29-Nov-89	18:40	30-Nov-89	18:20	23.67	23.20	98.0	48.91	1134.8
Blank	30-Nov-89		30-Nov-89						
Sample	30-Nov-89	18:35	01-Dec-89	18:35	24.00	2.10	8.7	49.79	104.6

TABLE 2. AMERICAN SAMOA, SAMPLE PARAMETERS FOR NOVEMBER 1989

FILTER TYPE (S or B)	DATE ON (UTC)	TIME ON (UTC)	DATE OFF (UTC)	TIME OFF (UTC)	TOT ELAP TIME (hrs)	RUN TIME (hrs)	RUN TIME (%)	FLOW RATE (m^3/hr)	AIR VOLUME (m^3)
Sample	01-Nov-89	23:20	02-Nov-89	23:10	23.83	23.10	96.9	43.27	999.6
Blank	01-Nov-89		01-Nov-89						
Sample	02-Nov-89	23:10	03-Nov-89	21:31	22.35	20.90	93.5	43.40	899.2
Blank	03-Nov-89		03-Nov-89						
Sample	03-Nov-89	21:31	05-Nov-89	00:47	27.27	26.70	97.9	43.40	1148.7
Blank	05-Nov-89		05-Nov-89						
Sample	05-Nov-89	00:47	06-Nov-89	22:00	45.22	45.20	100.0	43.02	1910.2
Sample	06-Nov-89	22:00	07-Nov-89	20:42	22.70	22.50	99.1	43.27	962.3
Sample	07-Nov-89	20:42	08-Nov-89	22:28	25.77	25.20	97.8	43.27	1077.8
Blank	07-Nov-89		07-Nov-89						
Sample	08-Nov-89	22:28	09-Nov-89	21:15	22.78	22.40	98.3	42.26	935.1
Blank	09-Nov-89		09-Nov-89						
Sample	09-Nov-89	21:15	10-Nov-89	22:00	24.75	24.70	99.8	41.48	1005.2
Sample	10-Nov-89	22:00	12-Nov-89	00:30	26.50	25.90	97.7	42.51	1081.2
Sample	12-Nov-89	01:05	13-Nov-89	22:05	45.00	45.10	100.2	43.77	1951.6
Blank	13-Nov-89		13-Nov-89						
Sample	13-Nov-89	22:05	14-Nov-89	22:10	24.08	24.10	100.1	43.27	1030.7
Sample	14-Nov-89	22:10	15-Nov-89	22:10	24.00	23.50	97.9	42.77	993.1
Blank	15-Nov-89		15-Nov-89						
Sample	15-Nov-89	22:10	16-Nov-89	22:54	24.73	24.30	98.2	42.00	1001.7
Sample	16-Nov-89	22:54	17-Nov-89	22:06	23.20	23.00	99.1	42.00	948.2
Blank	17-Nov-89		17-Nov-89						
Sample	17-Nov-89	22:06	19-Nov-89	05:20	31.23	30.00	96.1	42.00	1236.7
Sample	19-Nov-89	05:20	20-Nov-89	22:30	41.17	41.00	99.6	42.92	1766.0
Sample	20-Nov-89	22:30	21-Nov-89	22:18	23.80	23.00	96.6	42.92	990.7
Blank	21-Nov-89		21-Nov-89						
Sample	21-Nov-89	22:18	22-Nov-89	22:30	24.20	24.30	100.4	42.92	1046.7
Sample	22-Nov-89	22:20	23-Nov-89	22:30	24.17	23.90	98.9	42.92	1029.4
Blank	23-Nov-89		23-Nov-89						
Sample	23-Nov-89	22:30	25-Nov-89	00:25	25.92	26.90	103.8	42.00	1108.9
Sample	25-Nov-89	00:25	26-Nov-89	01:05	24.67	23.30	94.5	42.00	960.5
Sample	26-Nov-89	01:05	27-Nov-89	22:55	45.83	45.90	100.1	42.00	1892.2
Sample	27-Nov-89	22:55	28-Nov-89	23:00	24.08	19.50	81.0	41.48	793.6
Sample	28-Nov-89	23:00	29-Nov-89	22:30	23.50	16.70	71.1	40.95	670.7
Sample	29-Nov-89	22:30	30-Nov-89	22:48	24.30	1.30	5.3	41.48	52.9
Blank	29-Nov-89		29-Nov-89						
Sample	30-Nov-89	22:48	04-Dec-89	23:05	96.28	0.30	0.3	43.27	13.0

TABLE 3. RAROTONGA, SAMPLE PARAMETERS FOR NOVEMBER 1989

FILTER TYPE (S or B)	DATE ON (UTC)	TIME ON (UTC)	DATE OFF (UTC)	TIME OFF (UTC)	TOT ELAP TIME (hrs)	RUN TIME (hrs)	RUN TIME (%)	FLOW RATE (m^3/hr)	AIR VOLUME (m^3)
Sample	01-Nov-89	20:52	02-Nov-89	20:20	23.47	22.15	94.4	36.79	815.0
Sample	02-Nov-89	20:26	03-Nov-89	20:38	24.20	23.90	98.8	36.79	879.4
Sample	03-Nov-89	20:44	04-Nov-89	20:32	23.80	23.60	99.2	36.79	868.3
Sample	04-Nov-89	20:37	05-Nov-89	20:28	23.85	23.90	100.2	36.79	879.4
Blank	05-Nov-89		05-Nov-89						
Sample	05-Nov-89	20:34	06-Nov-89	20:22	23.80	22.20	93.3	36.79	816.8
Sample	06-Nov-89	20:28	07-Nov-89	20:20	23.87	20.70	86.7	36.79	761.6
Blank	07-Nov-89		07-Nov-89						
Sample	07-Nov-89	20:25	08-Nov-89	20:40	24.25	24.10	99.4	36.79	886.7
Sample	08-Nov-89	20:45	09-Nov-89	20:35	23.83	23.20	97.3	36.79	853.6
Blank	09-Nov-89		09-Nov-89						
Sample	09-Nov-89	20:40	10-Nov-89	20:44	24.07	3.90	16.2	36.79	143.5
Sample	10-Nov-89	20:49	11-Nov-89	20:42	23.88	0.30	1.3	36.79	11.0
Blank	11-Nov-89		11-Nov-89						
Sample	11-Nov-89	20:47	12-Nov-89	20:20	23.55	5.70	24.2	36.79	209.7
Sample	12-Nov-89	20:26	13-Nov-89	20:09	23.72	15.50	65.4	36.79	570.3
Blank	13-Nov-89		13-Nov-89						
Sample	13-Nov-89	20:13	14-Nov-89	20:39	24.43	7.05	28.9	36.79	259.4
Sample	14-Nov-89	20:44	15-Nov-89	20:44	24.00	21.55	89.8	36.79	792.9
Blank	15-Nov-89		15-Nov-89						
Sample	15-Nov-89	20:48	16-Nov-89	20:40	23.87	22.30	93.4	37.38	833.5
Sample	16-Nov-89	20:44	17-Nov-89	20:25	23.68	23.45	99.0	36.79	862.8
Blank	17-Nov-89		17-Nov-89						
Sample	17-Nov-89	20:30	18-Nov-89	20:43	24.22	21.15	87.3	37.38	790.5
Sample	18-Nov-89	20:47	19-Nov-89	20:15	23.47	9.65	41.1	36.79	355.1
Blank	19-Nov-89		19-Nov-89						
Sample	19-Nov-89	20:20	20-Nov-89	20:28	24.13	15.00	62.2	36.79	551.9
Sample	20-Nov-89	20:33	21-Nov-89	20:20	23.78	7.00	29.4	36.79	257.6
Blank	21-Nov-89		21-Nov-89						
Sample	21-Nov-89	20:25	22-Nov-89	20:35	24.17	0.60	2.5	37.38	22.4
Sample	22-Nov-89	20:40	23-Nov-89	20:38	23.97	2.30	9.6	37.38	86.0
Blank	23-Nov-89		23-Nov-89						
Sample	23-Nov-89	20:43	24-Nov-89	20:36	23.88	2.10	8.8	36.79	77.3
Sample	24-Nov-89	20:40	25-Nov-89	20:45	24.08	15.70	65.2	36.79	577.7
Blank	25-Nov-89		25-Nov-89						
Sample	25-Nov-89	20:50	26-Nov-89	20:35	23.75	4.80	20.2	38.51	184.9
Sample	26-Nov-89	20:40	27-Nov-89	20:32	23.87	10.70	44.8	37.38	399.9
Blank	27-Nov-89		27-Nov-89						
Sample	27-Nov-89	20:39	29-Nov-89	05:23	32.73	0.10	0.3	37.95	3.8
Sample	29-Nov-89	05:28	29-Nov-89	20:36	15.13	0.00	0.0	36.79	0.0
Blank	29-Nov-89		29-Nov-89						
Sample	29-Nov-89	20:42	30-Nov-89	20:30	23.80	0.10	0.4	37.38	3.7
Sample	30-Nov-89	20:35	07-Dec-89	20:58	168.38	23.60	14.0	37.95	895.6

TABLE 4. NORFOLK ISLAND, SAMPLE PARAMETERS FOR NOVEMBER 1989

FILTER TYPE (S or B)	DATE ON (UTC)	TIME ON (UTC)	DATE OFF (UTC)	TIME OFF (UTC)	TOT ELAP TIME (hrs)	RUN TIME (hrs)	RUN TIME (%)	FLOW RATE (m^3/hr)	AIR VOLUME (m^3)
Sample	04-Nov-89	23:30	05-Nov-89	23:30	24.00	0.00	0.0	44.02	0.0
Blank	05-Nov-89		05-Nov-89						
Sample	05-Nov-89	23:30	06-Nov-89	23:30	24.00	0.00	0.0	43.02	0.0
Sample	06-Nov-89	23:30	07-Nov-89	23:30	24.00	0.00	0.0	43.26	0.0
Sample	07-Nov-89	23:30	08-Nov-89	23:30	24.00	0.00	0.0	43.26	0.0
Blank	07-Nov-89		07-Nov-89						
Sample	08-Nov-89	23:30	09-Nov-89	23:30	24.00	0.45	1.9	42.25	19.5
Sample	09-Nov-89	23:30	10-Nov-89	23:30	24.00	0.25	1.0	42.77	10.8
Blank	09-Nov-89		09-Nov-89						
Sample	10-Nov-89	23:30	11-Nov-89	23:30	24.00	4.00	16.7	42.51	173.1
Sample	11-Nov-89	23:30	12-Nov-89	23:30	24.00	0.10	0.4	42.00	4.3
Blank	12-Nov-89		12-Nov-89						
Sample	12-Nov-89	23:30	13-Nov-89	23:30	24.00	0.00	0.0	42.77	0.0
Sample	13-Nov-89	23:30	14-Nov-89	23:30	24.00	9.60	40.0	42.77	415.4
Blank	14-Nov-89		14-Nov-89						
Sample	14-Nov-89	23:30	15-Nov-89	23:30	24.00	25.10	104.6	42.77	1086.1
Sample	15-Nov-89	23:30	16-Nov-89	23:30	24.00	23.70	98.7	43.52	1049.0
Blank	16-Nov-89		16-Nov-89						
Sample	16-Nov-89	23:30	17-Nov-89	23:30	24.00	14.20	59.2	42.00	607.3
Sample	17-Nov-89	23:30	18-Nov-89	23:30	24.00	0.00	0.0	43.02	0.0
Blank	18-Nov-89		18-Nov-89						
Sample	18-Nov-89	23:30	19-Nov-89	23:30	24.00	8.15	34.0	43.77	360.7
Sample	19-Nov-89	23:30	20-Nov-89	23:30	24.00	24.45	101.9	43.77	1082.2
Blank	20-Nov-89		20-Nov-89						
Sample	20-Nov-89	23:30	21-Nov-89	23:30	24.00	22.50	93.8	43.77	995.9
Sample	21-Nov-89	23:30	22-Nov-89	23:30	24.00	23.60	98.3	37.37	895.6
Blank	22-Nov-89		22-Nov-89						
Sample	22-Nov-89	23:30	23-Nov-89	23:30	24.00	17.50	72.9	37.08	664.1
Sample	23-Nov-89	23:30	24-Nov-89	23:30	24.00	16.40	68.3	38.22	640.8
Sample	24-Nov-89	23:30	25-Nov-89	23:30	24.00	7.40	30.8	36.49	276.6
Sample	25-Nov-89	23:30	26-Nov-89	23:30	24.00	7.05	29.4	37.37	267.5
Blank	26-Nov-89		26-Nov-89						
Sample	26-Nov-89	23:30	27-Nov-89	23:30	24.00	16.55	69.0	38.78	655.7
Sample	27-Nov-89	23:30	28-Nov-89	23:30	24.00	23.80	99.2	37.08	903.2
Blank	28-Nov-89		28-Nov-89						
Sample	28-Nov-89	23:30	29-Nov-89	23:30	24.00	24.40	101.7	37.93	953.3
Sample	29-Nov-89	23:30	30-Nov-89	23:30	24.00	17.80	74.2	37.08	675.5

TABLE 5. SHEMYA, ALEUTIAN ISLANDS, SAMPLE PARAMETERS FOR NOVEMBER 1989

FILTER TYPE (S or B)	DATE ON (UTC)	TIME ON (UTC)	DATE OFF (UTC)	TIME OFF (UTC)	TOT ELAP TIME (hrs)	RUN TIME (hrs)	RUN TIME (%)	FLOW RATE (m^3/hr)	AIR VOLUME (m^3)
Sample	02-Nov-89	19:05	09-Nov-89	19:00	167.92	96.20	57.3	62.20	5916.8
Sample	09-Nov-89	19:05	16-Nov-89	19:00	167.92	30.35	18.1	62.90	1888.0
Blank	09-Nov-89		09-Nov-89						
Blank	16-Nov-89		16-Nov-89						
Sample	16-Nov-89	19:00	23-Nov-89	19:10	168.17	91.85	54.6	62.03	5649.2
Sample	23-Nov-89	19:15	30-Nov-89	19:00	167.75	65.40	39.0	60.43	3905.1
Sample	30-Nov-89	19:10	07-Dec-89	19:00	167.83	91.00	54.2	60.79	5466.7

TABLE 6. KARAMEA, NEW ZEALAND, SAMPLE PARAMETERS FOR NOVEMBER 1989

FILTER TYPE (S/B)	DATE ON (UTC)	TIME ON (UTC)	DATE OFF (UTC)	TIME OFF (UTC)	TOTAL TIME (hrs)	RUN TIME (hrs)	RUN TIME (%)	FLOW RATE (m^3/hr)	AIR VOLUME (m^3)
Sample	20-Oct-89	4:25	27-Oct-89	4:15	167.83	71.50	42.6	48.69	3497.3
Blank	27-Oct-89		27-Oct-89						
Sample	27-Oct-89	4:20	03-Nov-89	4:15	167.92	33.75	20.1	50.01	1695.1
Sample	03-Nov-89	4:20	10-Nov-89	5:55	169.58	53.90	31.8	47.79	2588.2
Sample	10-Nov-89	6:00	17-Nov-89	6:10	168.17	70.50	41.9	47.79	3385.3
Sample	17-Nov-89	6:15	24-Nov-89	7:00	168.75	37.00	21.9	50.22	1874.3
Blank	24-Nov-89		24-Nov-89						
Sample	24-Nov-89	7:05	01-Dec-89	4:10	165.08	44.20	26.8	48.24	2142.3